Section 1011 – Materials Acceptance Program

1011.1 Material Acceptance Program Overview

The UDOT Materials Acceptance Program outlines the steps used to make an informed acceptance decision based on the quality of the materials incorporated into projects. UDOT uses a combination of sampling and testing, certificates of compliance, and inspection to determine materials acceptance and conformance with the approved project plans and specifications.

UDOT allows two options for obtaining sampling and testing results used in the acceptance decision:

> **Option 1** – Traditional acceptance is conducted by UDOT personnel according to the Minimum Sampling and Testing Requirements (MS&T) and project specifications. Sampling and testing activities are validated by independent assurance (IA) activities (MOI Section 1012).
>
> **Option 2 –** Non-traditional acceptance uses Contractor / Supplier quality control (QC) sampling and testing as part of the acceptance decision when material quality is validated by UDOT through testing and statistical verification.

In both options a qualified third party may be authorized to perform sampling and testing responsibilities for UDOT, the contractor / supplier, or both.

1011.2 Option 1 — Traditional Acceptance

The contractor is responsible for the quality of material, the quality of the workmanship and the management of the work.

Acceptance sampling and testing is performed by UDOT personnel in Department owned and operated testing facilities or by a UDOT designated agent in a UDOT qualified testing facility. Acceptance testing is performed in accordance with the MS&T and project specification by qualified technicians.

1011.2.2 Independent Assurance (IA) Activities

IA sampling and testing is performed by UDOT qualified laboratory personnel or a UDOT designated agent in qualified testing laboratories, in accordance with MOI 1012.

1011.3 Option 2 — Non-traditional Acceptance

UDOT may include QC test results in the acceptance decision. This allows using all available test results for the best statistical evaluation of acceptance properties. QC test results are used in the acceptance decision only when UDOT's verification sampling and testing, and IA programs validate the results. UDOT compares the test results statistically, which indicates whether the results contained in each set of data are consistent.

Note: Consistency is not accuracy, but an indication that the testing and sampling procedures produce similar results. If the results are consistent then UDOT can use the QC results with assurance that UDOT would have obtained similar results.

1011.3.1 Quality Control Plan

The QC test results can be used in the acceptance decision only when an acceptable Quality Control Plan (QCP) is used. Contract specifications outline the minimum QCP requirements. The Resident Engineer (RE) must approve the QCP. A simple example of a QC plan and its requirements are illustrated in Appendix B of this chapter.

1011.3.2 Verification Testing

When comparing UDOT and contractor test results, UDOT can either use the test results from a split sample or from samples that were independently obtained. This decision depends upon what material attribute or acceptance activity UDOT is trying to validate and whether UDOT wants to use the test results as part of the acceptance decision.

- If UDOT's objective is to compare the overall sampling and testing process, then verification testing should be done on **independent samples**.

- If UDOT's objective is to compare testing procedures or equipment, verification testing should be done on **a split sample** .

1011.3.2.1 Independent Samples

Samples taken independently of the QC samples can be used for verification of the QC results, or combined with the QC results for acceptance purposes, or both. If the two sets of test results are shown to be statistically consistent, then UDOT's test results may be combined with the QC test results and used in the acceptance decision.

1011.3.2.1 Split Sample

The results of multiple parties conducting tests on a single sample (split sample) are used for validation of test procedures and equipment. Multiple test results of a single sample may not be used in the acceptance decision but are used to verify results used in the acceptance decision.

UDOT's qualified representative witnesses and/or assists in obtaining the sample and takes immediate possession of one portion of the split sample to ensure the validity of the results. If a split of a sample is to be stored, the split sample is sealed with a signed and dated sticker by both the contractor and UDOT inspectors. Disturbed or damaged samples are not to be used in any dispute resolution process.

1011.3.3 Initial Validation

Initial validation of the QC test results are determined using the paired-t test with a level of significance of $a = 0.01$. The paired-t test is used during material production start-up and continues until UDOT has acceptable confidence in the QC testing program. See Appendix C in this chapter for a detailed explanation of the paired-t test concept.

Until the initial validation testing has been done, only UDOT's results can be used in the acceptance decision. UDOT can reduce its testing frequency and use QC results once an acceptable confidence level has been reached.

1011.3.4 Continuing Validation

The QC program and test results are validated continually over the course of material production using statistical analysis of the test results and the IA program for personnel, equipment, test procedures and laboratories.

Continuing validation of QC test results and UDOT's verification test results is accomplished by the F-test and t-test with a level of significance of a = 0.01. The F-test and t-test are used once acceptable populations of QC and Verification test results are established and the statistical analysis, using the paired-t test, is validated. The F-test and t-test is used until material production ends or the statistical analysis indicates that there is a problem with either population of test results, in which case UDOT initiates an investigation and resumes paired-t test evaluation until confidence in the contractor's QC testing program is restored. See Appendix D in this chapter for a detailed explanation of the F-test and t-test concepts.

1011.3.5 Non-validation

If comparison of test results indicates that the test results cannot be assumed to be similar, **the reason for the difference in the results should be investigated using dispute resolution procedures identified in project documents for the material in question.**

If the QC sampling and testing procedures or equipment were not in accordance with the contract requirements then the results should not be used in the acceptance decision. UDOT bases the acceptance decision on UDOT test results and additional testing if necessary. If UDOT's sampling and testing procedures or equipment caused the difference then UDOT takes additional tests to compare with the QC initial test results. **If this is not possible, the acceptance decision may be based on the QC test results, provided that previous validation comparisons indicates consistent results between UDOT and QC testing.**

1011.3.6 Testing Frequencies

Sampling and testing frequencies and definitions of lot size for quality assurance, quality control, and verification testing can be found in the Minimum Sampling and Testing Requirements and contract specifications.

1011.3.7 Risk Analysis

When data is not validated through F-test and t-test, a risk analysis is used to evaluate the material. Two acceptable methods for analyzing data are:

- **Qualitative Risk Analysis –** This method is a statistical analysis using QC results and Department independent results, comparing percent within limits with confidence levels defined in Table 1. Data showing acceptable risk levels can be used for pay determination.

- **Qualitative Economic Risk Approach** – This method compares the relative adjustments of UDOT verification results to QC results. When comparisons yield differences less than $600 for results within specification limits, QC results can be used for pay determination. If comparisons

yield differences outside the acceptable risk level or greater than $600 dispute resolution procedures apply.

Note - Risk analysis is limited to 2 lots per project

Table 1.

Structure Type	**Acceptable risk level**
Pre-stressed Concrete Members and Structural Concrete	97.5 Percent within Limits
Other Materials	95 Percent within Limits

1011.3.7 Dispute Resolution

Dispute resolution is used to resolve conflicts resulting from discrepancies between UDOT and QC results. Initial reviews are conducted to determine the magnitude of the discrepancy, if there is minimal or no impact to payment the dispute is dismissed.

Time durations should be agreed to and established before starting material production for resolution of disputes. Large variations may be sufficient cause to cease further production until the cause for the discrepancy is found. Limited production may be necessary while corrective measures are pursued. Correction of problems and performance of the final product should be the primary objective of the resolution process.

1011.3.7.1 Avoidance of Disputes

A monitoring program has been established that provides both the contractor and UDOT assurance that all data is reliable and unbiased. The main elements of the monitoring program are:

- All sampling and testing is performed by UDOT TTQP qualified testing personnel and laboratories.
- All testing labs are Qualified according to the UDOT Laboratory Qualification Program (LQP) MOI 1013.
- A stored split sample shall be sealed with a signed and dated sticker by both the contractor and UDOT inspectors. Disturbed or damaged samples are not to be used in the dispute resolution process.
- The Region Materials Laboratory acts as a third party check through Independent Assurance activities.
- Timely communication of test results between parties.
- UDOT and the contractor must fully understand the Quality Assurance Program. Questions regarding the Quality Assurance Program should be discussed during the pre-construction conference to clarify any confusion.

This monitoring program, conducted during material production and construction will normally detect potential conflicts between the contractor and UDOT quality processes.

1011.3.7.2 Third Party Resolution

To avoid bias in resolving differences between parties, a third party is used to resolve differences. This is not a negotiation process, but a method of identifying and resolving differences obtained using objective measurements.

1. Use of UDOT Central Laboratory

The third party should not be involved with either the QC, acceptance or verification processes. The central laboratory is viewed as an unbiased source although technically not totally independent of both parties. The central laboratory is typically in the best position to act as the third party arbitrator.

2. Independent Laboratory Requirements

An independent laboratory is required to meet UDOT's LQP, and the testing personnel must be certified under the UDOT TTQP. The selection of an independent laboratory should be made before beginning of the project. An updated list of pre-approved independent laboratories is available through the Quality Assurance Section and http://www2.udot.utah.gov/index.php/m=c/tid=196.

3. Cost of Resolution

If the additional testing and investigation indicates that UDOT's results are correct, the contractor pays the cost of the investigation. If the additional testing and investigation indicates that QC results are correct, UDOT pays the cost of the investigation.

When the central laboratory acts as the third party lab, fixed costs for performing various tests based on historical cost records have been established and can be made available upon request.

4. A split sample

The use of stored a split sample for either Contractor or UDOT results may be used when allowed by specification. The split sample can be discarded after determination of lot payment is agreed upon.

1011.3.7.3 Steps of Dispute Resolution

CASE 1: Contractor and UDOT test procedures for the same property are identical.

Dispute Resolution: In this case the test procedure is not in question. However, a comparison of QC and UDOT test results differs to such a degree that the material is considered rejected, the work must be corrected, a disincentive is imposed, or incentive is denied.

Step 1: Preliminary Project Investigation

When the project level statistical comparison indicates that the contractor's and UDOT's results are dissimilar, appropriate review of sampling procedures, testing procedures, testing equipment, and computations should be performed by project personnel responsible for the Quality Assurance program. The intent of this investigation is to make certain proper procedures are followed, equipment is properly calibrated and functioning, and computational errors are eliminated. If problems are found, corrective action should be taken.

Step 2: Third Party Investigation

When contractor QC results and agency results are dissimilar and the preliminary project investigation does not identify the cause, the situation should be forwarded to the designated third party for a more thorough investigation.

The third party should examine:

a. Past comparisons for the disputed item to identify any trends;

b. The results of the preliminary project level investigation; and

c. The results of the IA Program.

The third party should then test a stored split sample or new samples to compare with the QC and UDOT's test results.

The results obtained from third party testing are used to determine whether the QC or UDOT's initial test results more accurately represent the particular material property. The third party then recommends whether to require rejection, corrective work, a disincentive, or an incentive. The final recommendation of the third party is binding to both the contractor and UDOT.

CASE 2: Non-Test Result Related Disputes involve disputes on issues that cannot be quantified such as inspection-related disputes. These may include such items as:

- Segregation;
- Workmanship; and
- Manufactured products defects.

Dispute Resolution: A partnering agreement is recommended to handle disputes. A sample partnering agreement is in Appendix E. A separate procedure for conflict resolution should be developed and agreed to by the partnering participants. The procedure should include the following elements:

- Disputes should be delegated to the lowest appropriate level of authority on the project team to resolve within a specified time frame.

- A time frame for each level of authority should be established before the project begins.

- The procedure used at this level should include an attempt to quantify the dispute (e.g., the area of segregation), and its severity and impact on the performance of the product. In some cases, testing may need to be performed to assist in the determination. If testing is required, both parties first agree upon the sampling and testing plan, the testing agency, and the process for disposition of these findings.

- If the dispute is not resolved to the satisfaction of both parties within the specified time frame, the dispute is escalated to the next level of authority on the project team.

- If unresolved, the process continues to escalate to the highest level of authority where a final resolution would be arbitrated by an unbiased third party as discussed above.

- A written report describing the dispute, all subsequent actions, and final disposition should be submitted to the project records.